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MINUTES AND PROCEEDINGS of the

ARMY-NAVY-OSRD VISION COMMITTEE

THIRTEENTH MEETING - 10-11 JULY 1945

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M I N U T E S   A N D   P R O C E E D I N G S

of the thirteenth meeting of the

ARMY - NAVY - OSRD VISION COMMITTEE

10-11 July 1945

Institute of Optics
University of Rochester
Rochester, N. Y.

COPY NO. 159

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Vision Committee

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ARMY - NAVY - OSRD VISION COMMITTEE

MINUTES

Thirteenth Meeting
Institute of Cptics
University of Rochester
Rochester, N. Y.
10-11 July 1945

The following were present:

ARMY	AAF	(M)Major E. A. Pinson
		Lt. Col. Jack Matthews, AAF School of Aviation Medicine, Randolph Field, Texas
	AGO	(M)Dr. E. R. Henry, Personnel Research Section
	Eng	(A)Dr. George A. Van Lear, Jr., Engineer Board, Fort Belvoir, Virginia
	Ord	Dr. William S. Carlson, Frankford Arsenal
	SG	(M)Col. Derrick T. Vail
	WDLO	(M)Capt. Howard E. Clements
NAVY	BuAer	(A)Lt. Harry London
		(CM)Lt. Comdr. David Leavitt, Aircraft Camouflage Section
		Ens. Brian O'Brien, Jr., Aircraft Camouflage Section
	BuMed	Dr. Franklyn D. Burger, Research Project X423
	BuOrd	(M)Comdr. S. S. Ballard
		(A)Lt. Nathan H. Pulling
		Lt. (jg) Anne K. Bochan, Research and Development Div.
		Lt. Edward Tamler, Naval Inspector of Ordnance Office, Rochester, N. Y.
	BuShips	(CM)Comdr. Charles Bittinger
		Lt. Comdr. R. M. Langer, Physics Research Section
	MFRL	Ens. Conrad Mueller, Medical Field Research Lab., Camp Lejeune, N. C.
	NMRI	(CM)Dr. H. F. Blum
	NRL	(M)Dr. E. O. Hulburt
		(A)Dr. Richard Tousey
	ORI	Lt. (jg) Mary Wallace, Research Development Division
	SubBase	(M)Capt. C. W. Shilling
		(A)Lt. (jg)W. S. Verplanck
		Lt. Ellsworth B. Cook, Medical Research Department
		Lt. Dean Farnsworth, Medical Research Department
		Lt. J. H. Sulzman, Medical Research Department
	NAMC	Lt. John A. Bromer, Naval Air Material Center, Philadelphi
		Lt. (jg) Jesse Orlansky, Naval Air Material Center, Philadelphia

NAVY NAS Lt. Comdr. Lynn S. Beals, Comdr. Fleet Air, N. A. S., Quonset Pt., R. I.
Lt. Dean Ambrose, Dispensary, N. A. S., Corpus Christi, Texas
ORG Dr. George E. Kimball, Operations Research Group
Dr. E. S. Lamar, Operations Research Group

OSRD NDRC (M)Dr. Brian O'Brien
Dr. Loyd Jones, Section 16.3
Dr. Wilbur Rayton, Section 16.5
Mr. Walter Newcomb, Institute of Optics, University of Rochester, Rochester, N. Y.
APP (M)Dr. H. K. Hartline
Dr. Dael Wolfle, Technical Aide
CMR (M)Dr. Walter R. Miles
(CM)Dr. Selig Hecht
Dr. D. R. Griffin, Biological Laboratories, Harvard University
OSRD (M)Dr. Donald G. Marquis

Dr. Fred Jobe, Bausch & Lomb Optical Company, Rochester, N. Y.
Wing Comdr. S. R. C. Nelson, RAF Delegation

1. The chairman called for corrections or alterations in the Minutes and Proceedings of the twelfth meeting. There were no corrections.

2. Col. Vail presented for final Committee action Testing Visual Acuity - Manual of Instructions (Minutes, twelfth meeting, item 3, pg. 10) developed by the Subcommittee on Procedures and Standards for Visual Examinations. After discussion, the Committee 13*

VOTED: that the manual be adopted and recommended for standard Service use.

The manual in its final form appears as an Appendix to the Proceedings. Copies will be forwarded to the Office of the Surgeon General and to the Bureau of Medicine and Surgery for consideration and action.

A meeting of the Subcommittee on Procedures and Standards for Visual Examinations was announced for 24 July 1945 for consideration of improved standardized procedures for the measurement of phoria.

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*Numbers at the right refer to pages in the Proceedings on which the full report or discussion is presented.

3. Lt. Comdr. Peckham represented the Army-Navy-OSRD Vision Committee at a meeting of Subcommittee K on Filters of the War Committee Z52 on Photography and Cinematography, American Standards Association, on 14-15 June 1945. The Secretary presented Lt. Comdr. Peckham's report of the meeting at which proposed American War Standard Specifications for Photographic Filter Terminology and Nomenclature were developed. 15

4. Final action was taken on the Subcommittee on Design and Use of Binoculars formulation of answers to questions proposed by Comdr. Ballard (Nos. 3-10, <u>Proceedings</u>, twelfth meeting, pp. 24-26.) The Committee

VOTED: that the subcommittee answers be adopted.

5. Dr. Hulburt presented a report on binocular field trials, Naval Research Laboratory, 3 July 1945, carried out preliminary to the program of binocular tests being planned by the Subcommittee on Design and Use of Binoculars. 16

6. Lt. (jg) Verplanck reviewed plans for the binocular field trials now scheduled for September and October at the U. S. Submarine Base, New London, (<u>Minutes</u>, twelfth meeting, item 7, pg. 11).

7. Dr. Kimball presented the results of experiments on lookout scanning rates. 25**

8. Lt. (jg) Verplanck reported further modification of procedure of sky scanning for lookouts aboard ship for incorporation in the forthcoming <u>Lookout Manual</u> (NavPers 170069) (<u>Proceedings</u>, eleventh meeting, pg. 21). 18

9. Dr. Hecht presented the results of experiments on the effect of illuminating one eye on seeing with the other. 20

10. Dr. Tousey discussed briefly Naval Research Laboratory data on the effect of illuminating one eye on vision by the other. 24

** Confidential Supplement

11. The following new questions were discussed:

A. Dr. Blum suggested that information regarding the amount of exposure of solar radiation that can be safely tolerated by the human eye might be obtained in connection with the recent eclipse of the sun. He requested that filters used by individuals with observed scotomata as a result of viewing the eclipse be forwarded to the Naval Medical Research Institute, Bethesda, for analysis.

B. Bureau of Ships is concerned with the problem of legibility of markings. The Secretary requested that any information regarding work that has already been done on this problem be forwarded to the Secretary's Office.

12. Dr. O'Brien discussed briefly some of the wartime research of the Institute of Optics, University of Rochester, covering the general areas of visibility of targets at low levels of illumination, brightness of the night sky, extension of visibility curve, and self-luminous camouflage. References were given.

13. The Committee visited the Institute of Optics to observe the mechanical and optical shops and demonstrations of various devices that have been developed at the Institute.

14. The Committee participated in a night demonstration of the use of flares in air-ground observation range at the Institute of Optics.

15. Demonstrations of glass manufacturing, precision optical engineering, and inspection of military optical instruments at the Bausch and Lomb Optical Company.

16. Visit to the Research Laboratory, Eastman Kodak Company.

Abstracts**

**Confidential Supplement

ARMY - NAVY - OSRD VISION COMMITTEE

PROCEEDINGS

Thirteenth Meeting
Institute of Optics
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2. REPORT OF SUBCOMMITTEE ON PROCEDURES AND STANDARDS FOR VISUAL EXAMINATIONS

Digest of Discussion: Col. Vail presented the final draft of Testing Visual Acuity - Manual of Instructions for Committee action (Minutes, twelfth meeting, item 3, pg. 10).

Dr. Hecht asked for clarification of the reasons for the level of brightness recommended for illuminating the test chart (7-12 ft. ca., with an optimal value of 10 ft. ca.) Testing under conditions more nearly approximating natural daylight conditions of viewing would give a more useful measure, and small variations in illumination would be less important at the higher level.

Dr. Miles stated that the subcommittee had worked toward approximating the outdoor situation, but he thought it might be better to take a visual acuity measure without a definitely contracted pupil.

Dr. Marquis asked if there were any data showing that acuity measured at one level of illumination would not have high correlation with measures at another level of illumination. If there are no such data, the subcommittee is justified in choosing an illumination level near that in present use.

Dr. Hecht stated that there is evidence that the maximum visual acuity achieved is a function of the dioptric system. The relation of visual acuity and brightness may be the same in different individuals, but the variability at the highest brightnesses is determined by the dioptric mechanism.

Lt. Col. Matthews thought that the selection of the lower level of illumination is preferable because the most difficult job of discrimination is at sunrise and sunset and the test conditions should approximate this condition.

Dr. Hecht proposed that the illumination should be fixed more

rigidly. The range from 7 to 10 ft. ca. represents a variation of approximately 40%.

After discussion, the Committee agreed that the manual should be revised to read "The illumination of the targets shall be 10 foot-candles, plus or minus five percent."

The manual was then adopted by the Committee for recommendation to the Services.

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3. MEETING OF SUBCOMMITTEE K ON FILTERS OF THE WAR COMMITTEE Z52 ON PHOTOGRAPHY AND CINEMATOGRAPHY, AMERICAN STANDARDS ASSOCIATION

The following Bureau of Medicine and Surgery letter BUMED-X-aft-Ip/A11/F49-4 dated 11 July 1945 summarizes the work accomplished at the meeting of Subcommittee K on Filters of the War Committee Z52 on Photography and Cinematography, American Standards Association, 14-15 June, which Lt. Comdr. Peckham attended as a representative of the Vision Committee.

It was decided to classify filters as sharp cutting, gradual cutting, transmission band, absorption band and neutral. The first letter for each filter will be respectively S, G, T, A and N.

It was decided to name filters by their computed dominant wavelength on the ICI color diagram. The following colors will be represented: purple, violet, blue, green, orange, yellow and red. The second letter of the filter name will represent these colors respectively as P, V, B, G, O, Y and R.

Each filter name will contain two digits which represent the specific wavelength characteristics of the filter in centimicrons.

Filters containing a combination of neutral density will have a third number representing the density. This number will be followed by a decimal point.

The short name of the filter will contain all letters and numbers to the decimal point as, for example, "SY513.". This would indicate that the filter is a sharp cutting, yellow colored filter with its transition wavelength at 510 millimicrons, combined with a neutral density filter of .3 or approximately 50% transmission.

In addition to this information certain filters will be described more fully with respect to specific characteristics. This additional description as, for example, the width of the transmission band of a gradually cutting filter, will be indicated by appropriate and meaningful numbers following the decimal point. It was agreed that this system would permit description of filters as specifically as was desired. For instance, if one of a general class of filters was desired, the designation of letters only would be sufficient, but if a very specific filter was needed, the fullest designation could be used.

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5. QUALITATIVE FIELD TESTS OF BINOCULARS

The following Naval Research Laboratory letter R-S24(420)/R-420-39892/jfr dated 6 July 1945 records information presented at the meeting by Dr. Hulburt.

In view of the program of binocular tests being planned by the Subcommittee on Design and Use of Binoculars, of the Army-Navy-OSRD Vision Committee, some preliminary qualitative tests were carried out. These are described in the following paragraphs.

The binoculars used are listed in Table 1. The binoculars

Table 1

		Apparent field	Exit pupil	
Standard	7 x 50 x 7.1°	50°	7.1 mm	hand held
Wide field	7 x 50 x 10°	70°	7.1	" "
	9 x 63 x 5°	45°	7	" "
	10 x 50 x 7°	70°	5	" "
	20 x 120 x 3°	60°	6	mounted

had various types of eye guards or none at all. No attention was given to eye guards, but the opinion was reached that a proper eye guard is very important. All binoculars had low reflecting films.

Seven observers took part in the tests, Lt. N. Pulling, Lt. R. A. Wolmer, Lt. H. London, Dr. D. G. Marquis, Dr. H. K. Hartline, Dr. R. Tousey and Dr. E. O. Hulburt. It may be said that the observers were experienced. All tests were made on Chesapeake Bay.

Night test on 120 foot converted power yacht; starry night, no moon; Bay smooth; boat lying to, and under way; when under way at 10 knots there was little vibration. Targets were unlighted structures, trees, cliffs. The effectiveness of seeing things with the binoculars was observed to be in direct relation to their magnification. Targets were easily seen with the 20 power glass that could not be seen al all with any of the other glasses. The 10 x 50 glass was distinctly better than the 7 x 50 glasses; it was not noticeably better or worse than the 9 x 63 glass. The 10 x 50 glass was preferred over the 9 x 63, mainly because of the smaller field of view and greater length of the 9 x 63, but it was agreed that the 9 x 63 was a very good glass optically.

Day test on 30 foot boat. Bay moderate, breeze 8 knots, boat somewhat agitated. Only the hand held glasses of Table 1 were tested. The general opinion was that the 10 power and 7 power glasses were about equally effective, the advantage of the 10 power over the 7 power, due

to its increased magnification being about compensated by the disadvantage, due to the greater unsteadiness of the scene resulting from the greater magnification.

Throughout the tests there was discussion of the relative merits of the two 7 power glasses, of fields of view 7.1° and 10°. Some of the observers expressed preference for the wider field, some were neutral. It seemed to be that no situation occured, and no experiment was done, which was adequate to reveal the advantage of the wider field. No one would argue that, other things being equal, the wider field of view was harmful. It was argued that in a search situation the wider field might be advantageous. But all the search experiments that were attempted failed to be the sort to establish the advantage of the wider field.

Day test. The 10 x 50, 9 x 63 and standard 7 x 50 glass were used in daylight only by the operating personnel of a 125 foot converted power yacht during a week of manoeuvres on Chesapeake Bay. They reported a slight preference for the 10 x 50 over the other two binoculars.

Discussion: Dr. Hecht called attention to the recommendation of the Subcommittee on Design and Use of Binoculars that special attention be devoted to the design and development of head-rests or eye guards (Proceedings, twelfth meeting, question 8, pg. 26), and asked if a committee had been appointed to investigate this problem.

Lt. Pulling stated that a project has been set up at the Naval Gun Factory, but it is not anticipated that results will be available soon.

It was requested that Capt. Clements inform Army Ordnance of this project and suggested that Army Ordnance communicate its needs to the Bureau of Ordnance with regard to this problem.

8. MODIFICATION OF PROCEDURE OF SKY SCANNING FOR LOOKOUTS ABOARD SHIP

Lt. (jg) W. S. Verplanck

At the 11th meeting of the Army-Navy-OSRD Vision Committee, April, 1945, a scanning procedure was presented and agreed upon by the Vision Committee. Nevertheless, investigation of some of the time factors, such as those set forth in Dr. Kimball's report (see page 25), continued, and further modification of the procedure was made for incorporation in the forthcoming Lookout Manual (NavPers 170069.) It has not yet been formally accepted.

This newest procedure seeks to give detection at maximum range, consistent with most efficient use of personnel and most frequent coverage of each sector. It is based upon a departure from the standard procedure whereby each sky lookout is responsible for a sector of the sky from horizon to zenith.

It is proposed that all sky lookouts be divided into two groups, low-sky lookouts and high-sky lookouts.

Low-Sky Lookouts: Low-sky lookouts search with binoculars; they are responsible for the lowest five degrees of the sky. They sweep the horizon sector with binoculars from left to right, holding the horizon at the bottom of the binocular field. The binoculars are moved in five degree intervals, with a five second pause at each interval. On each pause the binocular field is scanned rectangularly with a minimum of twelve stops. These lookouts are supplemented by the surface lookouts and horizon lookouts who also search these critical small position angles.

High-Sky Lookouts: High-sky lookouts are responsible for their sector from horizon to zenith; they scan with the naked eye only, and use binoculars for identification after a target has been sighted. The initial sweep is made in quick steps from left to right just above the horizon, the return on a line approximately 10 degrees higher. This alternating scanning pattern is continued up to the zenith. Scanning is performed as fast as possible without incurring undue fatigue.

The proposed procedure should lead to much more frequent coverage of sectors than those proposed or used to date, and should yield sightings at the maximum practical range at all times.

The proportion of low-sky lookouts to high-sky lookouts is approximately 2 : 1. Thus a low-sky lookout might be responsible for 45° plus overlap, and a high-sky lookout for 90° plus overlap.

In critical areas such lookouts should be supplemented by sun lookouts or by zenith lookouts wherever practicable. This personnel also uses naked eye procedure.

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9. THE EFFECT OF ILLUMINATING ONE EYE ON SEEING WITH THE OTHER

Selig Hecht, Charles D. Hendley,
and Mark Amdursky

I. Problem

In making monocular observations with the naked eye, or with a telescope, microscope, or other visual instrument, one is confronted with the question of what to do with the other eye. Should it be merely occluded, completely shielded, dark adapted, light adapted, or specially illuminated? And this not merely for comfort, but for its influence on the performance of the observing functional eye.

Essentially the question involves the degree of independence of the two eyes, and aside from its immediately practical value in terms of instrument design and visual testing procedures, it is of theoretical interest for understanding binocular vision.

Experiments were therefore made to determine quantitatively the effect of wide variations in the brightness in one eye on the visual responses of the other eye. As a test procedure for the observing eye, we measured its brightness discrimination over a range of light intensities from zero to 3000 millilamberts.

II. Apparatus

The arrangements are such that measurements are made with the right eye, while the field brightness whose influence is being tested is in the left eye.

Right Eye. The set-up for the right eye is Shlaer's visual acuity apparatus (Shlaer, 1937) modified for brightness discrimination measurements. It presents to the eye a circular uniformly illuminated field 30° in diameter, whose brightness can be varied by neutral filters in approximately 0.3 log unit steps over the whole visual range. A 2 mm circular artificial pupil is always used.

From the same lamp which supplies this evenly illuminated field there is projected an additional small field in the middle region of the larger field. This small field may be independently varied in shape, size, position, and orientation by properly placed slits and diaphragms; it may be varied continuously in brightness by neutral filters and a neutral glass wedge; and it may be presented in definite exposures at regular intervals by an electrically controlled and operated camera shutter.

In all but four of the present experiments this small added field was an asymmetrical rectangle nearly 6.4' by 128', subtending a solid angle of exactly 800 square minutes. In two experiments the area was 100 square minutes and in two others it was 10 square minutes; in both these cases the asymmetry was 7 to 1 instead of 20 to 1 as before. In many of the experiments the small field was exposed for 3 seconds; in others for 0.5 seconds. None of these circumstances had any influence on the results.

At brightnesses below 0.2 millilamberts, the added ΔI field is presented 10° from the central fixation point temporally on the retina. Above 0.2 millilamberts the small added field is in the center of the surrounding 30° field at the fixation point.

Left Eye. Illumination for the left eye is provided by a 3.2 volt radio panel lamp placed at such a distance from a 10 power ocular that when the eye looks into the ocular it sees a circular uniformly illuminated field of 40° diameter. The lamp and ocular are mounted as a unit in a closed housing whose position can be carefully adjusted so that when the right eye is set exactly to look into the brightness discrimination instrument, the left eye sees the uniformly illuminated field in the ocular. The lamp circuit in the ocular field contains a potentiometer which controls the current in the lamp and thus varies the brightness of the field. It is adjusted to give a brightness of about 3000 millilamberts.

The apparatus as a whole is in a dark room. In addition the subject sits in a hood, which is open at the back and bottom, and into which the eye pieces for the left and right eyes project. The subject is also provided with a chin rest.

III. Procedure

The brightness discrimination threshold is measured by presenting a number of flashes, usually about 100, at several different brightnesses of the small field. That brightness at which the field is correctly seen 60 per cent of the time is taken as the threshold. As a criterion the subject is required to tell whether the small rectangular field is horizontal or vertical.

The subject is first dark adapted if measurements are to be made at low brightness. With the left eye in the dark, the intensity discrimination of the right eye is measured. Then the light in the left eye is turned on and the procedure repeated. Sometimes the order is reversed, the threshold being first measured when the left eye is at a high brightness, and then after a rest, when the left eye receives no light.

IV. Results

Three subjects were used in 24 experiments. All subjects have the right eye dominant. The background brightness in the right eye was varied in seven steps between zero and 3000 millilamberts. In most of the experiments the brightness in the left eye was set at about 3000 millilamberts. In a few the brightness in the left eye was made equal to that in the right.

The results are summarized in the following Table.

Background Brightness in millilamberts in Right Eye	Average Difference in log threshold of Right Eye when Left Eye is Dark or Brightly Illuminated
0.0000	+0.01
0.0021	+0.03
0.0041	+0.04
0.16	-0.06
17.5	-0.04
1500.0	+0.03
3000.0	+0.07
Average	+0.01

It is apparent that the right eye threshold is not influenced by the brightness in the left eye. The individual experiments show much the same small random differences as the averages given in the Table: we found larger differences on only two occasions, one of -0.24 and the other of +0.24 which of course cancelled each other. The average of all the differences is 0.01, which is well within the experimental error.

The most striking experiment is when the right eye is completely dark adapted and absolute threshold measurements are made with it. Turning on a very bright light in the left eye does not raise the threshold at all. The binocular impression is curious. With the bright light in the left eye, one sees a bright field through which the fixation point is barely visible. When the rectangular field in the right eye is flashed on, one sees this as an additional brightness superimposed on the bright field.

The bright light in the left eye is ~~annoying~~, and tires the subject more quickly than when the left eye is dark; but the threshold of the right eye is not affected. In one experiment an irregular pat-

tern composed of straight and curved lines was added to the bright field in the left eye. This increased the annoyance to the subject but again did not change the threshold.

V. Conclusion

In absolute and in relative threshold measurements with one eye, the condition of illumination of the other eye is without influence. When the brightness disparity between the two eyes is great there is some annoyance, in making the measurements, but the results are the same as when the non-functioning eye is kept dark. Apparently, though the two eyes give a combined brightness sensation, they function independently in making brightness discrimination and absolute threshold measurements.

Discussion: Dr. Burger asked about the effect of pupil size on refractive error. Dr. Hecht explained that for these experiments an artificial pupil of 2 mm. was employed.

Dr. Tousey has prepared the following summary of his remarks concerning work done at the Naval Research Laboratory relating to the effect of illuminating one eye on seeing with the other (see page 24).

10. NOTE ON THE EFFECT OF ILLUMINATING ONE EYE ON VISION BY THE OTHER

Dr. Richard Tousey

Several years ago during a determination of threshold intensities of a point source viewed against a bright uniform backgound it was observed that illumination of one eye reduced the threshold for the other. The type of illumination was not important and a flashlight directed into one eye was found to reduce the threshold of the other. The effect was discussed in NRL report H-1788 of 1 October 1941. Recently further experiments were performed on point source thresholds with monocular and binocular vision and with binocular vision but with only one eye seeing the point source, the vision of the other being blurred very slightly with a lens. The thresholds for binocular vision but with only one eye seeing the point were less than the monocular thresholds and approximately midway between the monocular and binocular thresholds. The effect was observed for foveal vision only and over a wide range of background brightness from 0.01 to 1000 microlamberts. No artificial pupil was used.

A possible explanation of the effect appeared to be that illumination of the second eye contracted the pupil of the first and so reduced the retinal brightness of the extended background considerably. However, the pupil contraction did not greatly reduce the brightness of the image of the point source because of the spherical aberration of the eye lens. It merely eliminated the halo surrounding the point image, the halo being produced by spherical aberration from the outer zones of the lens. The magnitude of the effect was never greater than 50 per cent and appeared to depend on the exact condition of focus of the eye since it varied considerably with changes of less than one diopter in lens correction.

Further experiments indicated that the effect did not exist for extrafoveal vision, probably because vision off the fovea was not as acute as at the fovea. Nor did the effect exist when an artificial pupil was used. Hence there appeared to be no conflict with Dr. Hecht's interesting experiments with an artificial pupil recently reported to the Vision Committee.

A full report of the experiments will be published eventually.

APPENDIX

TESTING VISUAL ACUITY

MANUAL OF INSTRUCTIONS

This manual has been developed by the Subcommittee on Procedures and Standards for Visual Examinations of the Army-Navy-OSRD Vision Committee. It was adopted by the Vision Committee, and recommended for Service use at the thirteenth meeting, 10 July 1945.

TESTING VISUAL ACUITY
MANUAL OF INSTRUCTIONS

TESTING VISUAL ACUITY
MANUAL OF INSTRUCTIONS

Visual defects are one of the major causes for physical disqualification from the Armed Services of the United States. Methods of testing vision have varied greatly among the Services and from place to place in each Service. In consequence, visual test results are not comparable. A candidate presenting himself for examination at one center might be qualified for visual acuity while at another center he would be disqualified. The purpose of this manual is to describe the conditions and equipment necessary and the procedures to be followed in order to correct this situation.

<u>The procedures outlined in this manual are to be followed by every person who administers visual tests.</u>

Section I. THE EXAMINATION

A. NECESSARY CONDITIONS

1. Physical Equipment

Tests shall be given in a room where arrangements, charts and illumination are in good order and as described in Section II of this manual. If the arrangements do not meet the requirements of this manual, the fact shall be brought to the attention of the Medical Officer-in-Charge.

2. Condition of Candidates

Every effort should be made to examine men who are in normal physical condition. When possible, liberty should be restricted for 24 hours before examination. Men should not be tested within 24 hours after travel or arduous duties. If it is suspected that failure on any test is due to poor physical condition, retest after rest should be arranged.

B. TESTING ACUITY FOR DISTANT VISION

1. Procedure

a. The candidate's glasses must be removed before he enters the examining room. Each man shall be tested without unnecessary delay after he has entered the room. In order to prevent personnel from memorizing the charts, only one candidate shall be permitted to view the targets at a time. Candidates awaiting test must be kept out of hearing.

b. The candidate is directed to the indicated 20 foot mark. The examiner holds the occluder and covers the candidate's left eye, while instructing the candidate to keep both eyes open without squinting. The occluder must not be permitted to touch any part of the eye to be shielded, but should be held in contact with the side of the nose.

c. The candidate is directed to begin at the top of the chart and to read as many lines as possible.

d. The smallest line read on the chart from the 20 foot distance shall be recorded as the vision for the right eye (V. R.) in accordance with regulations in effect.

e. The acuity for the left eye (V. L.) is then tested, using a different chart and recorded in the same manner.

f. Finally, the visual acuity for both eyes (V. B.) may be taken, if regualtions require it, with a third chart and recorded.

g. A candidate who normally wears glasses all the time is tested again with them in place. The same procedure is followed as without

glasses, for right eye, left eye and both eyes, changing charts for each test.

h. When there is suspicion that the candidate has memorized the charts, he is to be directed to read the letters or targets in reverse order or will be shown a different chart. When suspicion still remains, the candidate should be referred to the Medical Officer-in-Charge.

i. The candidate is expected to read the letters promptly. No precise time limit should be applied but 1 or 2 seconds per letter is ample time.

j. When a candidate fails a letter or target he should not be asked to read it again. If the candidate is a rapid reader and his mistakes are obviously careless ones, he should be cautioned to "slow down" and the test should be repeated on another chart.

k. Some men give up easily. They may need encouragement to do their best. However, no coaching shall be given by the examiner.

2. <u>Score recording</u>

a. Vision is recorded in the form of a fraction. The upper number is the distance in feet from the targets, and the lower number is the value of the smallest test chart line read correctly. Thus, a person reading the 30 foot test chart line at a distance of 20 feet is given a score of 20/30. 20/20 indicates that a person reads the test chart line marked 20 at a distance of 20 feet. Similarly, 20/200 means that a person can read only the test chart line marked 200 from a distance of

20 feet.

b. When glasses are worn the record should read as follows:

	V. R. 20/...		V. R. 20/...
Without glasses	V. L. 20/...	With glasses	V. L. 20/...
	V. B. 20/...		V. B. 20/...

3. <u>Suggested useful phrases for use by the examiner</u>

a. "Please stand here (indicating the place). Hold your head still and straight. Keep both eyes open when I cover your left eye."

b. "When I cover your eye, don't close it, for that interferes with the test."

c. "Start at the top and read as many lines as you can."

d. "Don't squint. Don't screw up your eyelids or frown."

e. "Look straight ahead."

f. "Don't rub your eyes."

g. "Read promptly -- too much effort will tire your eyes and make it harder."

h. "Don't hurry -- get each one right that you can because you won't have another chance."

i. "The next line may be hard but try it anyway."

j. "If you're not quite sure, make a guess -- play your hunches."

4. <u>Precautions to be observed in conducting tests for visual acuity.</u>

a. It may be extremely difficult to obtain an accurate measure of visual acuity. The examiner must bear in mind that men who are anxious

to pass tests of visual acuity will resort to deception in certain cases. Similarly, other men may take any means in order to fail a visual test when undesirable duties are in prospect. Hence, the examiner must be prepared to cope with either possibility so that he can uncover and recognize visual defects without the obvious cooperation of the person being tested.

b. The examiner must watch the candidate - not the chart which he is reading. The occluder must be held in such a manner that the candidate cannot peep around it. The most frequently used method of increasing visual acuity is to squint with the eyelids (screw up the eyelids). This is not to be permitted. Some people with astigmatism will be able to read the letters better by tilting the head to one side; do not allow them to do this.

c. Another well known method used to pass a test for visual acuity is to obtain eyedrops beforehand which contract the pupil. If the pupils are unusually small, the attention of the Medical Officer must be called to the fact.

d. The occluder must not be pressed against the eyeball or lids, but rather it should be held against the side of the nose. The eye shielded by the occluder should be open in order to avoid pressure and to discourage squinting.

e. Some men may appear to be malingering when they are not, and, on the other hand, the most innocent-appearing person may be the worst

malingerer. If malingering is suspected, the candidate should be referred to the Medical Officer at once.

5. The Examiner

a. The examiner must be neat in uniform and professional in manner.

b. Test results determine the duties to which personnel will be assigned; therefore, too much care cannot be taken in tests for visual acuity if every man is to be utilized to the best purpose.

c. The examiner must be unhurried and persevering if accurate results are to be secured. A patient, tolerant and painstaking attitude on the part of the examiner will reassure the candidates and increase the accuracy of the visual acuity test. Haste and irritation are to be avoided.

d. The examiner should undertake to memorize the test targets. If necessary, he may hold in his hand a small card on which the targets are reproduced, in order to verify the responses. In any event some accurate check of the responses should be made.

e. The routine of examination must be followed carefully in the order described. The vision for each eye should be recorded as soon as it is determined so that errors and omissions will be avoided.

C. TESTING ACUITY FOR NEAR VISION

1. Near vision is tested by placing a Lebensohn near vision test chart at a distance from the eye determined by the string on the chart.

The length of the string may vary from the standard 14 inches to 21 inches depending upon existing regulations. Precautions should be taken to insure that a candidate does not pull the target nearer or push it away to a distance appreciably different from that prescribed. It is important that the Lebensohn chart be kept clean by washing with soap and water.

2. The test is performed without and then with glasses as described in the paragraphs pertaining to distant vision.

3. The candidate is directed to begin at the top of the chart and to read as many lines as possible. Each eye is tested separately, then, if regulations require it, both eyes together, as described under tests for distance.

4. For this part of the examination illumination should come from behind and above or from overhead, but never from in front of the person being tested.

5. Recording is in terms of the smallest letters or words read at the test distance. The initials V. R., V. L., V. B. are used to designate vision in right eye, left eye, and both eyes respectively.

D. RETESTS

1. The effects of fatigue and alcohol may make a certain amount of retesting necessary. In questionable cases one retest shall be given not less than the day after the initial test.

2. Occasionally an excuse is given for failure to pass the test due

to temporary injury to the eyes. Examples are: that the candidate has gotten something in one or both eyes, that he has been exposed to welding flash, to bright sun, etc. Such cases are to be referred to the Medical Officer.

Section II. TESTING ROOM AND EQUIPMENT

A. THE ROOM

1. Size

The room used for testing visual acuity must provide a distance of twenty feet between the eyes of the person being examined and the targets.

> The use of a mirror at ten feet to provide the equivalent distance by reflection should be avoided if possible. If the use of a mirror is unavoidable, it must be face silvered, and it must be cleaned with extreme care, using only a camel's hair brush supplied by the maker. The surface will lose its original luster within 6 months, and must be returned to the factory for renewal. (Alphabet charts must be reversed when used with mirrors.)

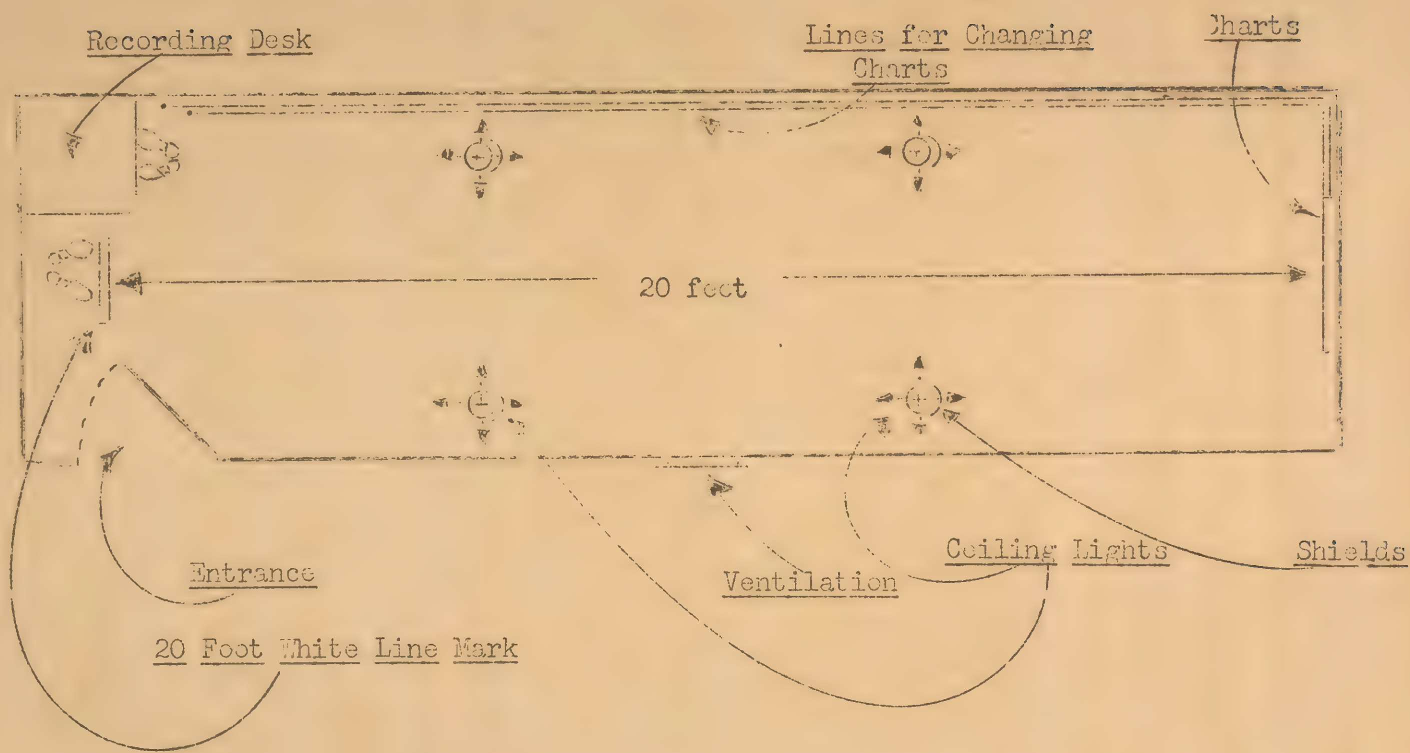
2. Equipment

A desk, stand, or high shelf shall be placed so that the examiner can observe the candidate while recording the responses. The 20' mark must be carefully measured and clearly marked. (See accompanying room plan.)

3. Ventilation

Provision for adequate ventilation of the testing room is

ESSENTIALS OF EYE TESTING ROOM PLAN



necessary. This is of paramount importance.

4. Color

Walls shall be painted with flat, non-glossy, light gray paint of 40% reflectance or within the range of 25-50% reflectance. Walls must not be black. Ceilings should be painted white in order to approximate 75% of reflection.

> The inside of the cover of this manual has a reflection of 42% and may be used as a sample to which the paint can be matched. One-eighth pint of lamp black (one tube) to seven gallons of flat white paint will approximate this gray. It will cover between 200 and 300 square feet per gallon depending upon the amount of oil and turpentine used in the first, second, and third coats.
>
> It is important that the trim, frame, or panel on which the charts may be mounted should be painted a gray which is not darker than the walls. As a matter of appearance and upkeep the general room trim, casings, etc., may be painted a slightly darker, semi-gloss, gray.

Windows and glass doors shall be completely covered or curtained with material which is not in contrast with the color of the walls.

5. Security

When the room is unused, there must be no access to the targets by persons who might profit by memorizing them.

B. ILLUMINATION

1. Room Illumination

The illumination of the testing room at head height shall be uniform within a range of 7-12 foot-candles, with the optimal value at

10 foot-candles.

> Light from fixtures or openings must be shielded so that it does not shine in the candidate's eyes. There must be no glare sources or areas of high contrast in the field of view around the test charts.

> The quality of light is immaterial; Mazda incandescent, or fluorescent is suitable.

2. Target Illumination

The illumination of the targets shall be 10 foot-candles, plus or minus five percent. Under no circumstances shall the target be illuminated so that shadows or reflections are visible on the charts.

C. TEST CHARTS

At least three charts must be available. As rapidly as they are made available, only targets approved by the Army-Navy-OSRD Vision Committee shall be used.

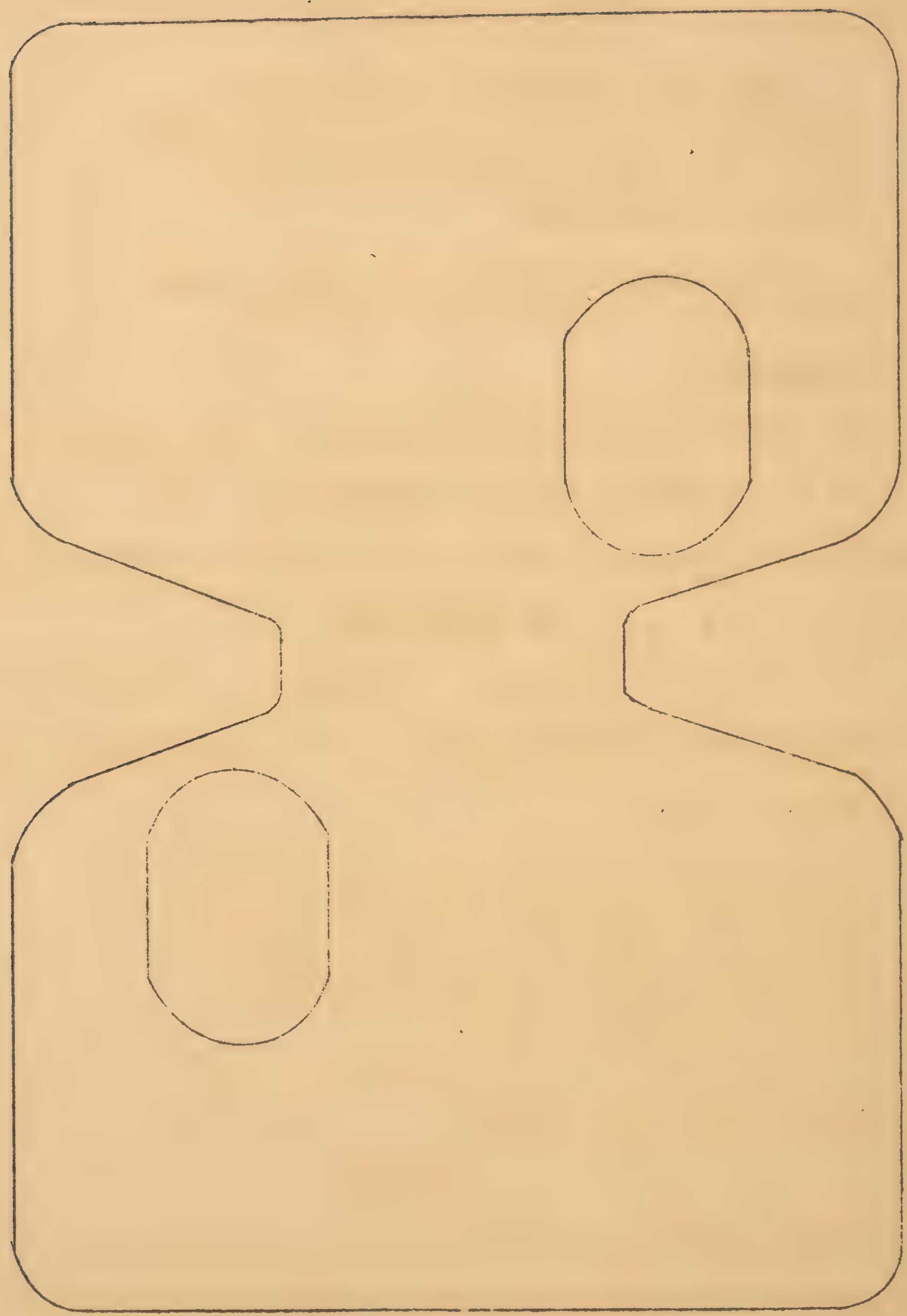
> Transilluminated viewing boxes (letters on transluscent material illuminated from behind) are not recommended unless the brightness of the background has been standardized in conformity with the values given under "Chart Illumination" above.

> Projected test targets will not be used for testing visual acuity.

D. OCCLUDER

A rigid occluder, constructed of a material such as wood, transluscent plastic, or metal, shall be provided to shield the eye not being tested.

> An excellent design to discourage cheating is illustrated below.



Suggested Design for Occluder

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

SUPPLEMENT TO

MINUTES AND PROCEEDINGS

of the

ARMY-NAVY-OSRD VISION COMMITTEE

MEDICAL

THIRTEENTH MEETING - 10-11 JULY 1945

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SUPPLEMENT
to

MINUTES AND PROCEEDINGS

of the thirteenth meeting of the

ARMY - NAVY - OSRD VISION COMMITTEE

10-11 July 1945

Institute of Optics
University of Rochester
Rochester, N. Y.

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7. SOME EXPERIMENTS ON LOOKOUT SCANNING RATES

Dr. George E. Kimball

Introduction

At the present time the most immediate problem facing the Navy is the defense of task forces against enemy air attack, particularly by suicide planes. Without discussing this problem in detail, it should be obvious that lookouts play a most important role in this defense. The fundamental job of a lookout under these circumstances is to detect the enemy plane in time for the anti-aircraft guns to be brought to bear at their maximum range. This is by no means simple, because the planes most frequently appear out of cloud cover, and very often within a few thousand yards of the task force. Since a 300-knot plane covers 10,000 yards in one minute, it is obvious that speed of detection is all-important, while the ranges are such that devices to increase visual range have little significance. Moreover the problem is a daylight problem, since practically all of these attacks are made in daylight. The problem is, therefore, to detect a small, but otherwise easily visible target, as rapidly as possible. Present scanning procedures have not been designed with this in mind, and fall far short of the speed required. Moreover they fail to take into account that in enemy waters every man on deck is now regarded as a lookout, and that the gun crews are the most important lookouts of all.

There are other visual problems at the present time, but none approaching this in importance. Others which may be mentioned are sky lookouts on submarines, who are growing in importance as more submarines are assigned to lifeguard duty which requires them to surface in daylight. There is the problem of look-out from aircraft, particularly in air-sea rescue work, and in interception patrol work. Both of these are also characterized by being problems involving a need for speed and daylight illumination. There is the problem of the gun pointer who must get his director on a rapidly moving target with only an approximate knowledge of where to find it.

Some General Considerations

In most of these problems, and certainly the most important, the performance of a lookout is to be measured by the <u>speed</u> with which the target is located, after it is once within visual range. For the present, let us simplify the problem by assuming that the target suddenly appears within the field of view of the lookout. We may then describe his performance by the <u>average time</u> it takes him to detect the target.

Now suppose that the lookout uses a scanning procedure which repeats every T seconds. Then even if the target is <u>sure</u> to be seen

on every scan, it will take the lookout an average of T/2 seconds to make the detection. If there is a chance that the target is missed on any scan the time will obviously be longer. It can easily be shown that if P is the probablility of picking up the target on any single scan, the average time of detection is

$$t = \frac{T}{2}\left(\frac{2-P}{P}\right) \qquad (1)$$

Since P must be less than 1 it is obvious that t is greater than T/2.

This drives us to the inevitable conclusion that if we want to pick up targets quickly we must scan quickly. If it is important to pick up a target within 15 seconds, we must not use a 90 second scanning time. The obvious way of cutting down the scanning time is to use more lookouts, assigning each one a smaller sector. If this is done, the detection time will be inversely proportional to the number of lookouts. But there is a limit to the number of lookouts which can be used, and even when the maximum number is used it is still important for each individual to scan in such a way as to pick up his targets as quickly as possible.

Now it must be admitted that the faster the scanning, the greater the risk that the target is missed on any given scan. In other words if we decrease T we also decrease P. It is, therefore, important to know just how P depends on T. There are only two types of dependence which might reasonably be expected. These are shown in Fig. 1. In Type 1 the probability P is proportional to T for small values of T, i.e. for fast scanning, but the curve falls off from proportionality as T increases, and finally approaches the asymptote $P = 1$. In Type 2 the value of P is very small for small values of T, so that the curve is tangential to the T-axis near the origin. As T is increased, P finally increases in an S-shaped curve, and again becomes asymptotic to the line $P = 1$.

By means of equation (1) these curves may easily be converted to curves of average detection time against scanning time. The results are shown schematically in Fig. 2. If the P-T curve is of Type 1, the t-T curve has no minimum. The curve is horizontal at $T = 0$, and as T increases the curve approaches the asymptote $t = T/2$. A Type 2 P-T curve, on the other hand, has an infinite value of t for $T = 0$, as T increases t first decreases to a minimum, and then increases, again approaching the asymptote $t = T/2$.

If minimum average detection time is wanted, then if the P-T curve is of Type 1, the scanning should be as fast as possible, while if the P-T curve is of Type 2, the optimum scanning rate is that which gives the minimum for t. The whole problem, therefore, rests on the

determination of the P-T curve.

Experimental Procedure

Experiments can easily be carried out to determine the probability of picking up a given target in a given scan. It is only necessary to have observers scan a suitable field on which targets may be caused to appear. The scans are carried out one at a time, and a record made of whether the target is detected or not. To prevent bias on the part of the observer, the target position should be changed after each scan. After a number of scans have been made, the fraction of the scans on which the target was detected gives the desired probability

This procedure may be illustrated by a series of experiments carried out in the Spring of 1945 by Dr. Henry Hemmendinger of the Submarine Operations Research Group and the personnel of the Lookout School at the U. S. N. Submarine Base, New London, Conn. These experiments were carried out on the standard Lookout Stage. The targets were a series of eight silhouettes, of three different contrasts, and four different areas. The illumination levels varied from 10^3 to 10^7 micro-micro-lamberts, and were controlled by a Variac in the lighting circuit. The observers were five enlisted men chosen from a group of seven all of whom had recently had the regular lookout training course at New London. These men were tested for night vision with the Hecht adaptometer. The two men rejected were rejected because of irregular performance on the adaptometer. The remaining five gave consistent adaptometer readings and seemed to be generally normal.

In carrying out the observations one man placed a given target at a predetermined position on the stage, a second acted as recorder, recording the target, target position, stage brightness, the times at the beginning and end of the scan and of the discovery of the target, if seen. The third man acted as observer using 7x50 binoculars. These positions were rotated every half hour. In this way each man made 20 scans at a time. In a full day 320 scans were recorded. The total in the whole series was about 6000.

Observations were started only after 45 minutes of adaptation, the last thirty of which were in the darkroom. To reduce daily variations the men were furnished with Navy sunglasses, with instructions to wear them during any exposure to bright sunlight for periods longer than about fifteen minutes.

After the first exploratory observations, scans alternated between slow and fast. A metronome was used for one day to aid in adjusting a constant rate of scan. It was then removed, and a reasonable constancy was obtained without it. The men were instructed as follows:

<u>Slow Scan</u>: Move the binoculars five degrees every five seconds. At any position of the binoculars, keep the horizon fixed about one-half degree above the center of the field. Scan within the binocular field in some systematic pattern, such as fixating on six symmetrically distributed points each about 1 degree from the edge of the field.

<u>Fast Scan</u>: Move the binoculars five degrees every second. No specific instructions were given regarding systematic scanning of the field within each position of the binoculars, since it appeared that this rate of scan allowed only one or two fixations per position.

Results

As might be expected the probability of detection in a single scan was found to be higher for the slow scan than for the fast scan. In either case the probability was small at very low levels of illumination, and increased to unity as the illumination was increased. A typical example of this behavior is shown in Fig. 3. In the upper set of curves the probability of detection is plotted against the illumination for a typical target (Target C3: contrast .41: area 527 square minutes). In the lower set of curves, these probabilities have been converted into mean detection times by equation (1). This second pair of curves shows that in spite of the lower probability in a single scan, the mean detection time is smaller for the fast scan than for the slow scan at the higher levels of illumination. Only at the lowest levels is t smaller for the slow scan than for the fast scan, and these levels t is already so large, and the probability of detection in a single scan so small that considerable doubt would exist in the mind of the lookout as to whether the target was actually detected or not.

This result was generally found to hold for all the targets. In fact there is a very sharp correlation between the probabilities of detection with the two scanning speeds. This is shown graphically in Fig. 4, in which the probability of detection in a single fast scan is plotted against the probability of detection in a single slow scan. Each point in this scatter diagram represents all the observations made on a given target at a given illumination. The points fall as closely as can be expected on the smooth curve shown. This means simply that for all practical purposes we can predict the probability of detection in a single fast scan if we know the probability in a single slow scan, regardless of the nature of the target or the illumination, at least within the range covered by these experiments.

The curve of Fig. 4 can also be transformed by means of equation (1) into a curve of detection times. The result is shown in

Fig. 5, where the mean detection time using fast scanning is plotted against the detection time using slow scanning. The detection times only become equal when they are both about 600 seconds or approximately 10 minutes. It would again be doubtful that such a barely visible target would be accepted as real.

Conclusion

These tests were not extensive enough to establish the form of the P-T curve we discussed at the beginning of this paper. The fact that for very weak targets the slower scanning rate does give smaller detection times is an indication that for such targets at least the curve is of Type 2. In all probability the curve is always of Type 2, but even if this is so it seems that the minimum in Fig. 2 comes at a very small scanning time for most targets which can be seen at all, and that slow scanning is only effective against very inconspicuous targets.

In some tactical situations such inconspicuous targets remain on the threshold of visibility for long periods. In such cases slow scanning is proper. But in most of the pressing problems of the moment this is not the case, and fast scanning is definitely required for best results.

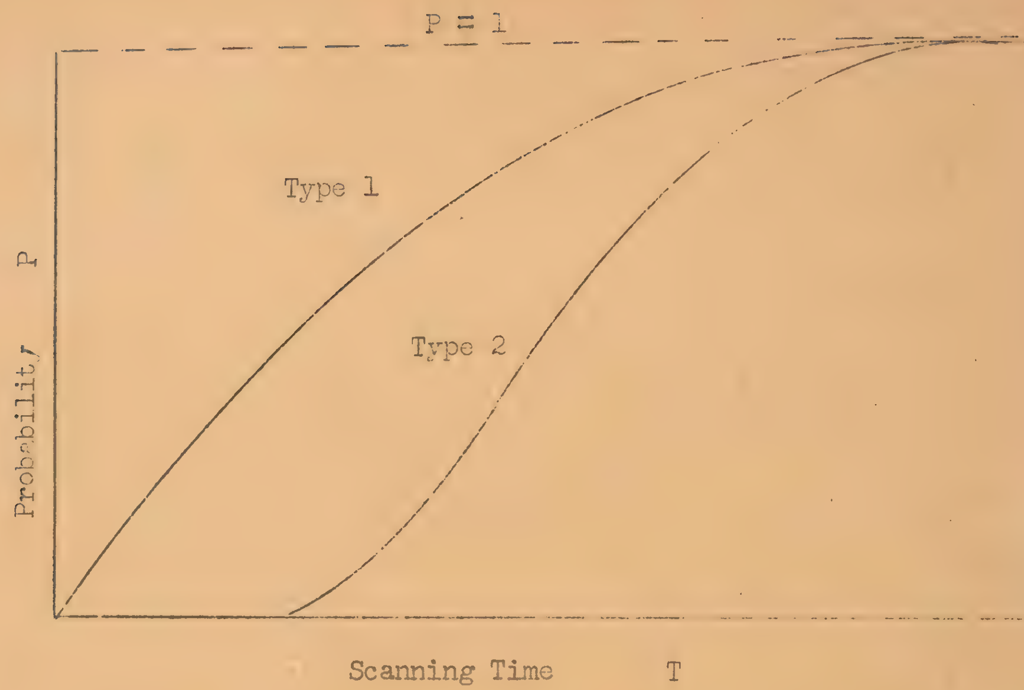


Figure 1. TYPES OF P - T CURVES

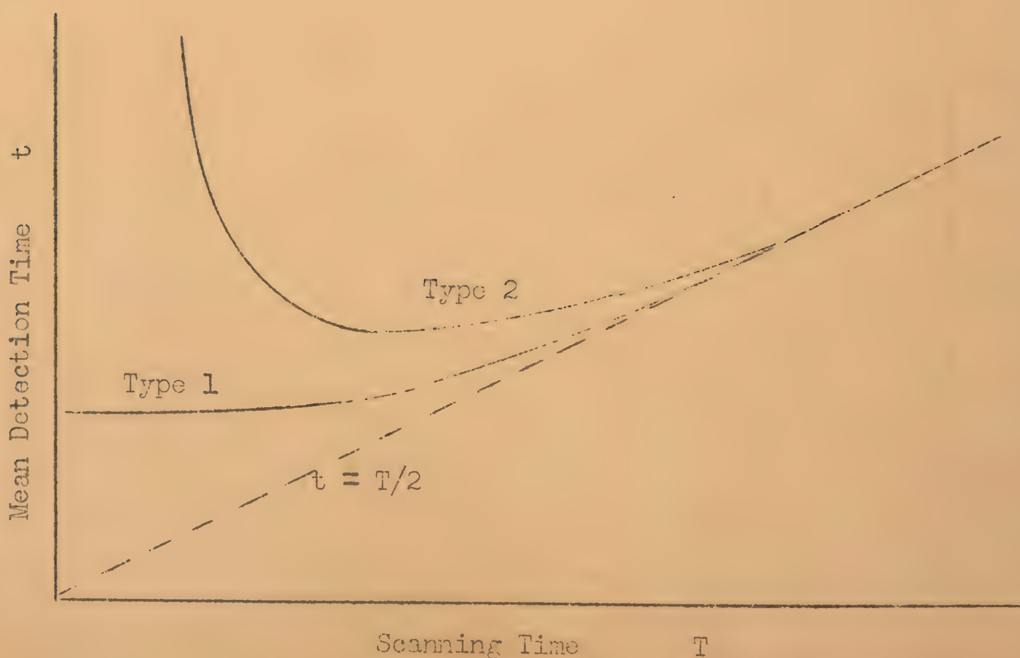
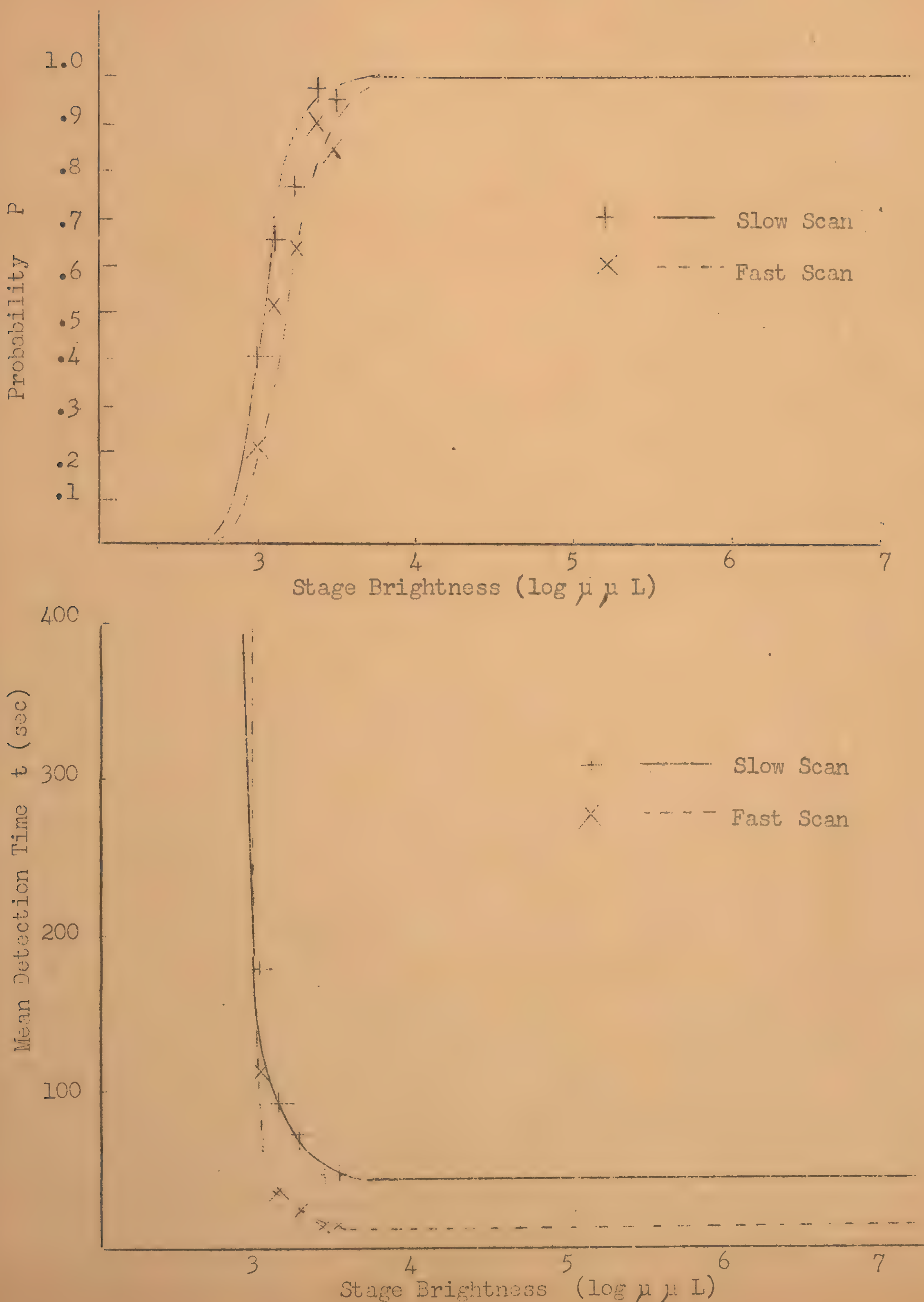


Figure 2. TYPES OF t - T CURVES

Figure 3. EFFECT OF STAGE BRIGHTNESS



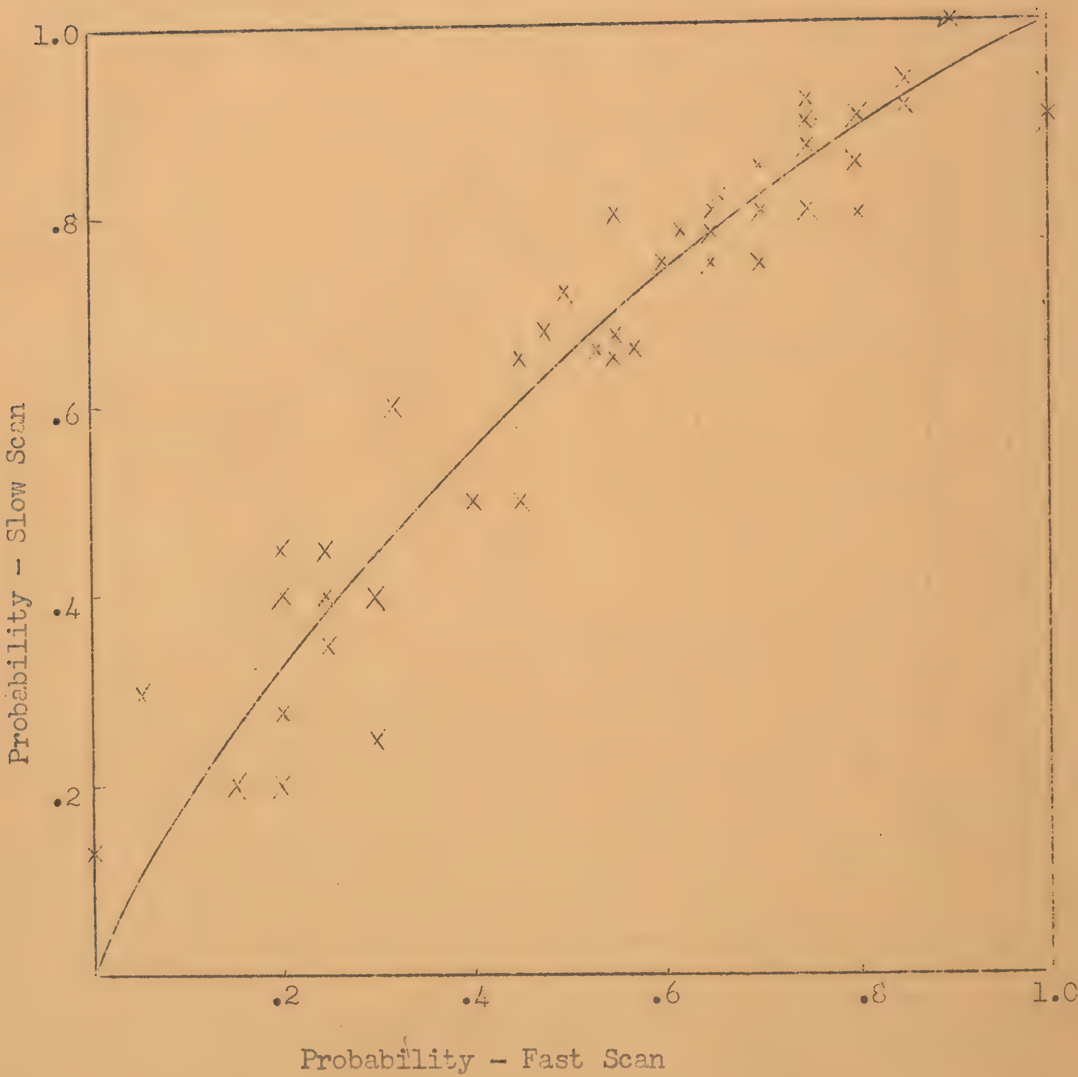


Figure 4. CORRELATION BETWEEN PROBABILITIES ON SLOW AND FAST SCANS

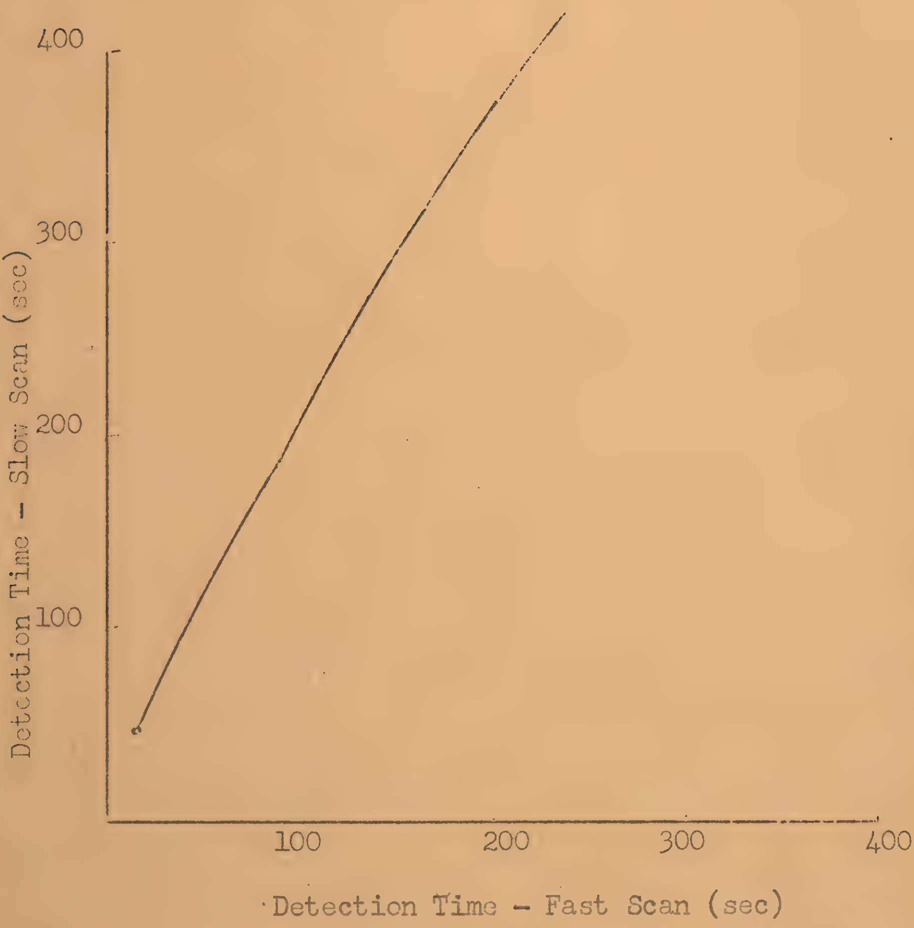


Figure 5 - DETECTION TIMES FOR SLOW AND FAST SCANS

ABSTRACTS

91. VISIBILITY OF TARGETS OF SERVICE IMPORTANCE – RANGES OBTAINED WITH 7 x 50 BINOCULARS.

Admiralty Research Laboratory. A.R.L./R.3/85.14/0, 13 March 1945, 16 pp. (Confidential)

This report is a continuation of the work previously reported in A.R.L./R.1/85.14.0 and A.R.L./R.2/85.14.0 (the basic work on physiological data relating to the visibility of targets of service importance.) It gives ranges of visibility of targets when the observer uses 7 x 50 binoculars.

The present report gives results for different types of targets and for different conditions of meteorological visibility and brightness. It does not include discussion of effects due to waterline depression or to directional lighting.

92. VISIBILITY OF TARGETS OF SERVICE IMPORTANCE – WATERLINE DEPRESSION EFFECT.

Admiralty Research Laboratory. A.R.L./R.4/85.14.0. 3 April 1945, 19 pp. (Confidential)

This report supplements an earlier report (A.R.L./R.2/85. 14.0) by taking into account the effects on the range of visibility due to the fact that from heights of observation in common use part of the target is below the horizon. If the target is nearer than the horizon different parts of the target have different contrasts against the background and this substantially affects the range of visibility.

The relative advantages of observers at different heights under typical conditions are discussed.

93. THE EFFECT OF REFRACTIVE ERROR ON ABILITY TO SEE AT NIGHT.

Air Technical Service Command. Eng. Division. Aero Medical Laboratory. Memorandum report, TSEAL3C-695-48, 11 July 1945, 11 pp. (Open)

In the interests of proper night vision testing procedure and indoctrination of personnel in the most effective ways of seeing at night, this study was designed to determine whether personnel who wear corrective glasses can see better at night with or without their glasses. Twenty-eight subjects with varying amounts of refractive error were tested six times each with the Johnson Foundation Luminous Plaque Adaptometer. Half of the trials were made with the subjects wearing their correction and the other half without. The report concludes that individuals with myopia and/or myopic astigmatism can see better at night if they wear corrective eye-glasses. Individuals with hyperopia and/or hyperopic astigmatism within the range of values tested see better at night without their corrective eye-glasses. The present study indicates that when the refractive system of the eye is near-sighted or myopic, the loss of light from reflection and absorption ih the spectacle lens at low levels of illumination is more than compensated by its corrective properties for the sight of the observer.

94. NIGHT VISION DEMONSTRATION

The following report may be secured or consulted in the office of the Vision Committee.

In order to incorporate night vision training in the standard RAAF Advanced High Altitude Course, apparatus has been designed to provide a night vision demonstration and adapted to the limitations set by the Decompression Chamber. The report includes a description of the apparatus, photographs with self-explanatory construction details and a description of demonstration techniques.

95. VARIABLE DENSITY AND VARIABLE COLOR FILTERS FOR USE WITH RADAR SCREENS TO PRESERVE DARK ADAPTATION

Tousey, R., National Research Laboratory. N.R.L. report no. H-2539, 21 May 1945, 12 pp. (Restricted)

In order to provide a means for control of the effect on night vision of aircraft radar screens, two filters were designed. The first was uncolored and of variable density, and consisted of two polaroid disks, one of them rotateable. The second included in addition to the polaroids a second rotateable member, a wave retardation plate, which permitted the screen to be made redder at the same time as dimmer. Both types permitted instantaneous blackout of the screen, which is not possible electrically, as well as nearly maximum brightness. A model of the first type was submitted to the Bureau of Aeronautics for flight test. The second type did not appear worth further development unless a P-7 screen with more emission in the red were available.

96. FIELDS OF VISION FROM FIGHTER AIRCRAFT.

Leyzorek, M. and W. J. Romejko. Air Technical Service Command. Engineering Division. Aero Medical Laboratory. Memorandum report, TSEAL3-695-48E, 7 June 1945, 21 pp. (Open)

In this study of fields of vision from military aircraft in the taxiing position, AAF, Allied, and enemy fighter aircraft were tested. Visual field size is computed from the angular limits of the field of vision in any direction as measured by the gyro-theodolite (see Abstract No. 85) and is expressed quantitatively in steradians. The aircraft tested are compared in terms of magnitude of the total field of vision and visibility over the nose. No attempt is made to evaluate the adequacy of these fields; problems of evaluation are discussed in an appendix. The report concludes that fighter aircraft differ significantly and considerably in the size of the total field of vision available to the pilot and in the extent of visibility in specific directions (e.g. over the nose), and that visibility over the nose in some AAF fighter aircraft is inadequate for the full utilization of gunsights designed for deflection shooting. It is recommended that specific design characteristics resulting in larger fields of vision be incorporated in fighter aircraft of the future and that the office of Flying Safety initiate a project to determine the extent that such improvements may reduce aircraft accidents.

97. PHYSICAL STATUS SURVEY OF OVER A QUARTER MILLION ENLISTED AIR FORCE PERSONNEL

Eidam, Carl L., The Air Surgeon's Bulletin, 1945, 2 (7), 204. (Restricted)

In the period January, 1943 - August, 1944, 261,530 air force enlisted personnel were given physical examinations at one medical processing center of the Second Air Force. 13,139 were disqualified for foreign duty. This report shows (1)the number of air force enlisted men with physical defects, (2)the most common defects existant, (3)the probable causes of increases and decreases of incidence of certain disqualifying conditions. (4)discharge of air force enlisted personnel as influenced by MR 1-9 (Standards of Physical Examination During Mobilization) 15 October 1942, and succeeding changes, and companion circulars.

Of the 13,139 men disqualified, 15.5% were disqualified for defective vision. The trend of incidence of this defect is decreasing; during the period January, 1943 - December, 1943, defective vision was responsible for 20% of the total disqualified, while from January, 1944 - August, 1944, 5.15% were disqualified for visual defects. During both periods the mumber disqualified was approximately 5% of the total examined.

98. REPORT ON THE STANDARDIZATION OF NIGHT LOOKOUT STAGES

Verplanck, W. S., Bureau of medicine and surgery project X-350 (Av-197-p) Interval report no. 1, 24 May 1945, 5 pp. (Open)

The Medical Research Department, U. S. Submarine Base, has received reports of the results of Night Lookout Training from 40 activities throughout the Navy. These reports include data on more than 500,000 men trained following a standard procedure.

Each report has been analyzed with respect to the percentage of men sighting the target at each brightness level and at the corresponding voltmeter setting, and median values for all reporting activities have been derived.

With these data used as a basis, each activity has been advised as to the proper voltmeter settings to employ, so that the training at the great majority of reporting activities has been rendered relatively uniform.

99. FACTORS DETERMINING ACCURACY OF RECEPTION OF OSCILLOSCOPE CODE

Lindsley, D. B., I. H. Anderson, A. L. Baldwin, R. S. Daniel, W. H. Lichte, T. L. McCulloch, and E. J. Sweeney. Project SC-70, NS-146, Research report no. 18, Contract OEMsr-919, O.S.R.D. report no. 5280, 19 June 1945, 14 pp. (Confidential)

Oscilloscope codes with dot-to-dash ratios of 1 to 4.3, 1 to 5, and 1 to 6.3 were read with approximately equal accuracies and were all superior to code with a ratio of 1 to 3. The dot-to-dash ratio of 1 to 4 (or 4.3) is recommended because it is more nearly like conventional code than the other ratios and was read with equal accuracy. Code at a speed of 6 bauds per second is recommended because code at this speed was read more accurately than code at 8 bauds per second and with accuracy about equal to that of code at 4 bauds per second. Width- and amplitude-modulated signals were read with equal accuracy. Two-letter code was read with slightly more accuracy than three-and four-letter code; the latter two were read with approximately equal accuracy. The time plan for the present two-letter code system detracted from the accuracy with which the code was read and caused occasional reversals in grouping(such as DA for AD). It is recommended that the time plan be changed to shorten the interval between the first and second letter of the group.

100. DEFICIENT COLOR PERCEPTION - NEW TESTS

Sloan, Louise L., The Air Surgeon's Bulletin, 1945 2 (6), 166, (Restricted)

This article presents a summary of the work at the AAF School of Aviation Medicine which led to the adoption of an abridged version of the American Optical Company pseudo-isochromatic charts as the basic color vision test for flying personnel and the SAM Color Threshold Test as an adjunct test to determine the degree of defect of those failing the basic test.

The AOC test was made simpler and more reliable by eliminating charts relatively easy for color deficient subjects and also those that are relatively difficult for normal subjects. Recommendations on lighting and presentation of the abridged version obviate difficulties encountered in using the standard AOC test.

The adjunct test was devised to measure ability to distinguish colored signal lights. Classification and analysis of color discriminations required of aircrew indicated that such discriminations offer the greatest difficulty to the color deficient person. The test is described and the method of scoring and test-retest reliability (0.88) are discussed. The validity of the scores was studied through several types of practical field tests. References are given.